UNITED STATES

DEPARTMENT OF THE INTERIOR

BUREAU OF MINES

METAL AND NONMETAL MINE HEALTH AND SAFETY

HEALTH STUDY (ASBESTOS DUST)

LIBBY MINE AND MILL

W. R. GRACE AND COMPANY
LIBBY, LINCOLN COUNTY, MONTANA

MAY 18-21, 1971

By

WALTER BANK, Staff Mining Engineer

and

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METAL AND NONMETAL MINE
HEALTH GROUP

Mr. Glen W. Sutton,
Chief

- Originating Office
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Denver, Colorado 80225

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

DISTRIBUTION SHEET

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Washington, D.C.

Originating Office: Field Health Group, Denver, Colorado (2)

Mine: Libby Mine and Mill I.D. No: 59000-00-24-027

Company: W.R. Grace and Co. Underground ____ Open Cut X
Construction Products Division
Operated by: same

Survey by: Walter Bank and Ronald J. Uhle

Location: Libby, Lincoln County, Montana

Survey Dates: May 18-21, 1971

Company Officials: Robert Oliverio, Manager (6)
Luther M. Krupp, Mine Supt.
John D. Riggleman, Mill Supt.
(P.O. Box 609, Libby, Montana 59923)

State Agencies: Roy Jameson, Safety Director (2)
Montana Industrial Accident Board
Helena, Montana

* Union: Stationary Operating Engineers (2)
AFL-CIO Local 361, Harold Shrewsbury, President,
Box 552, Libby, Montana

Other: Chief, Health Division, Washington, D.C. (1)

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INTRODUCTION

This report is based on a study made pursuant to Section 5 of the Federal Metal and Nonmetal Mine Safety Act (80 Stat. 772, P.L. 89-577, 30 U.S.C. 721-740).

GENERAL INFORMATION

The open-pit vermiculite mine and mill are located about ten miles northeasterly of Libby, Montana. Concentrate bins are located at the junction of the mine road and Montana Highway 37 alongside the Kootenai River, and are connected with the concentrate shipping point (the Burlington Northern Railway) by means of a belt conveyor suspended over the river.

The W. R. Grace and Company, Construction Products Division, P.O. Box 609, Libby, Montana, owns and operates the mine (formerly known as the Zonolite mine) which consists of 55 patented and 19 unpatented claims. Mine officials were: Earl D. Lovick, Manager; Luther M. Krupp, Mine Superintendent; John D. Riggleman, Mill Superintendent; and Ken Sipila, Safety Engineer.

The mine was operated two 8-hour shifts a day, 6 days a week; the mill was operated three 8-hour shifts a day 6 days a week. The mine produced about 550 tons of concentrate a day, with a total (including office staff) of 170 employees. The orebody ran 10-15 percent vermiculite and the mill feed averaged 30 percent. The life expectancy of the mine is indefinite.

The oval-shaped open pit was mined in 28-foot-high benches using 3 1/2-yard capacity diesel-powered shovels which loaded ore or waste into 35-yard capacity diesel-powered dump trucks. Holes which were drilled 30-feet deep and 6 1/4 inches in diameter were loaded with ammonium nitrate prill.

The ore body is described as an altered pyroxenite with vermiculite dikes disseminated through it. Tremolite in asbestos form, galena, chalcopyrite, pyrite, apatite, and magnetite are present as minor constituents. The tremolite is disseminated in varying percentages throughout the ore. High-grade tremolite was once mined and stockpiled for anticipated sale as asbestos.

DESCRIPTION OF STUDY

All mineral forms of airborne asbestos dusts have been considered hazardous and may lead to the pneumoconiosis called asbestosis, or to a distinctive type of lung cancer known as mesothelioma.

All control measures applicable to mineral dust control are used for airborne asbestos; however, the comparatively hazardous nature of asbestos requires more stringent adherence to good control practices. At the Libby mine and mill, the following practices were noted:

1. Roadways were oiled to minimize the dissemination of dust.

2. The drill was provided with a Pangborn baghouse dust collector.

3. A drill used for drilling boulders for secondary blasting reportedly was provided with water.

4. Bureau-approved Dustfoe 77 and American Optical R9-100T respirators were provided for work in dusty areas, and clean filters were furnished on request. Respirators were required for some job operations and some areas.

5. The tester van was provided with an exhaust hood.

6. The dry mill, which processed 5 percent of the ore, was provided with a low-pressure exhaust system. Primary cyclones removed the coarser dust from the exhaust air, and the fines went out the stack. Exhaust hoods covered the screens, roll crushers, and other dust-producing equipment; the enclosed bucket conveyors were tied into the exhaust system. Above the first floor, respirators were required to be worn.

7. One sweeper was provided for each shift in the dry mill.

8. The wet mill involved wet processing which minimized dust production; spilled material was handled by a cleanup man.

9. The mine, mill, and loading station were monitored for fibrous dust on a monthly basis. Selected men wore personal samplers for two hours, and the samples were submitted for counting to Werby Laboratories, Inc., 88 Broad Street, Boston, Massachusetts.

10. The feed on belts contained 4 percent moisture; this quantity of water helped to minimize dust dissemination.

11. In the open pit, dilution ventilation was the main control measure; in the mill, open windows and the open structure with interconnected floors permitted the wind to carry some of the dust-laden air to the outside.

12. The skip operator was provided with an enclosed control booth.

13. At the railroad loading dock, the operator was within an enclosed booth and a cyclone exhaust system was provided for the car-filling operation.

14. In the mine office, a sweeping compound was used during cleanup.

At the time of the study, the pit, broken waste, and ore were wet from previous rain and snowfalls. During the sampling, rain and snow fell intermittently. Reportedly, more airborne dust was present under dry-weather conditions.

The effectiveness of the control measures will be discussed later in this report.

One-hundred and fifty-four samples were collected. Of these, four nuclepore filter samples were submitted to Dr. Phillip DeNee, Safety Research Center, Bruceton, Pennsylvania, for evaluation; results are not available for inclusion in this report. A settled dust sample was submitted to the Field Health Group analytical laboratory; results of the analysis are included in Appendix 1. One-hundred and forty-nine airborne dust samples were collected on membrane filters; of these, six samples could not be evaluated, but the others were counted in the Denver Field Health Group laboratory, at approximately 460 magnification with phase contrast illumination according to the method established by the U.S. Public Health Service. Pumps were calibrated at the mine office at an airflow rate of either 2.0 or 1.4 liters per minute. Full-shift exposure samples were collected of those individuals presumed to be exposed to highest dust levels; other samples were collected of representative individuals or of locations where men worked. Sampling locations are described in Appendix II and are referred to the map noted as Figure 1.

DISCUSSION AND RESULTS

In 1967, the published TLV 1/ was 5 mppcf (millions of particles per cubic foot of air) for asbestos-bearing dusts when collected conventionally with the impinger or midget impinger and counted conventionally with the standardized

1/ Threshold Limit Values for 1967, Recommended and Intended Changes; American Conference of Governmental Industrial Hygienists, 1967.

microscope counting method. What the number concentrations represented, in effect, were the visible fragments of asbestos fibers plus the many associated mineral dust particles.

In 1968, the published "Notice of Intended Changes" proposed (1) that the 5 mppcf be dropped to 2 mppcf; and (2) an alternative figure of 12 fibers/ml. greater than 5 microns in length be adopted - this TLV figure was to be determined by the membrane filter method at 430X phase contrast magnification.

The above two proposal changes were retained in 1969; in 1970 the published proposed changes (1) dispensed entirely with the impinger sampling method and its number concentration figure; and (2) recommended that the TLV be changed from 12 fibers/ml. greater than 5 microns in length to 5 fibers/ml. greater than 5 microns in length. The fiber concentration figures were to be determined by the membrane filter method at approximately 430X phase contrast magnification.

For purposes of this health study, the writers believed that the latest (1970) proposed TLV figures and sampling methods gave the best indication of the asbestos dust health hazard. Therefore, the proposed 5 fibers/ml. (on a time-weighted basis) is used as the threshold limit value.

Fiber concentration figures and pertinent data for the individual airborne dust samples are listed in Appendix II. The fiber concentration data are summarized in Figures 2, 3, 4, and 5.

On a time-weighted-average basis, the top-floor operator was exposed to more than five times the proposed TLV. He was required to wear a respirator on all but the first floor of the mill, or practically all the shift.

The bottom-floor operator was exposed to seven times the proposed TLV. He was required to wear a respirator on all but the first floor of the mill, and despite his title, this meant practically all shift. The first floor presumably was relatively dust-free, but observation and the single area sample (sample A-211) and office and lunch room samples indicated that the first floor was dusty.

Two sweepers were sampled; both were exposed to seven times the proposed TLV. They were required to wear respirators in the dry mill on all but the first floor. During the sweeping and cleanup process, the settled dust, while being swept, fell through cracks in the floor and added to the ambient dust load in the air.

The tails-belt operator spent his time on the first floor where no respirator was required. Much of his duties involved working with wet muck in a wet area. Nevertheless his time-weighted average exposure was more than double the proposed TLV.

The exposure of four millwrights were evaluated. Their duties in or around the mills involved a wide range in airborne dust exposures, and all the arithmetic averages were well above the 5 fiber/ml. figure.

The shifter periodically made tours through the dry and wet mills checking on conditions. His exposure also averaged two times the proposed TLV figure.

The electrician's exposure was six times the TLV figure while working in the dry mill. The skipper's exposure also was five times the TLV figure; his duties, while being sampled, included blowing down a hangup in the chute and operating the skip controls.

In the wet mill and in the assay labs, samples were either slightly above or below the proposed TLV figure. Men who were sampled included the jig operator, the filter operator, the day tester, the shift tester, the assayer and the assistant shop foreman. The wet operations and the exhaust hoods in the laboratories minimized dust dissemination.

Fourteen men were sampled at various operations in the open pit. Although not evident in Figure 4, a number of the average number concentration figures are close to time-weighted averages, and represent non-hazardous conditions at the time sampled. As mentioned previously, the ground was wet from rain and snow, and slight amounts of rain or snow fell during sampling. Men sampled were the shovel operator, the oiler on the shovel, shovel mechanic, shovel mechanic helper, mine ore tester, three truck drivers, the transfer point operator, the front-end loader operator, the dozer operator, the drill operator, the powder man (explosives), and the patrol operator.

The car loader, located in a control booth alongside the railroad tracks, filled cars with concentrate. Although protected in the booth, and although the loading equipment was provided with a Pangborn dust-collecting system, the exposure appeared high. Settled dust was noted above the railroad car roof slots. The dust collector was reported to be in process of repair.

The exposure of the loading dock foreman was very high. One sample yielded a 6.2 fibers/ml. count; the other sample was extremely high making it difficult if not impossible to count. The foreman was noted coming out of a conveyor gallery where dust concentrations were obviously high. A respirator was worn in that environment.

General air samples were collected in the dry mill; all fiber counts were high, ranging from 13 to 71 fibers/ml. General air samples were collected in the adjoining warehouse, the nearby machine shop, construction shop, mine office, and mine yard; all were well below the proposed TLV figure. As mentioned earlier, the dry mill was provided with a low-pressure exhaust system which collected the dusty air and sent it through cyclones and out a stack. At the time of sampling, the prevailing wind carried the stack effluent away from these sampled areas.

The union contract required bus transportation between the operation and the town of Libby. A sample collected in the bus going to town at end-of-shift, with the men wearing work clothes, yielded a count of 1.7 fibers/ml.

CONCLUSIONS AND RECOMMENDATIONS

In summation, exposures in the dry mill and associated areas were high. The low-pressure exhaust system and its associated canopy hoods were ineffective as a complete dust-control measure. The cleanup of spills and floor sweeping contributed to the dust load in the ambient air. The use of respirators should not be considered as a substitute for environmental control, and their continued use over prolonged periods is contrary to good industrial hygiene practices. In general, the first floor, where respirators were not required also appeared to have high dust levels.

In the mine, under conditions as they existed when sampled, no fiber dust concentrations above the TLV were noted.

Dusty conditions existed at the concentrate loading bins and railroad-car loading areas. The dust-collecting system reportedly was being repaired; additional samples should be collected when repairs are completed to determine the effectiveness of the system.

As reported, a new mill is slated for construction and completion at the end of 1972. Ground has been broken for the storage and blending bins (see figure 1 for location). The new plant will utilize a completely wet process, with driers being the only likely dust source.

Simple, specific recommendations cannot be made with respect to the dry mill because only a massive overhaul and redesign of equipment and its exhaust system could control the escape of airborne dust and spillages with their attendant cleanup (and dust dissemination). The new mill and its wet process hopefully will bring fiber levels down to acceptable figures.

ACKNOWLEDGEMENT

The authors greatly acknowledge the cooperation and assistance of company officials and employees.

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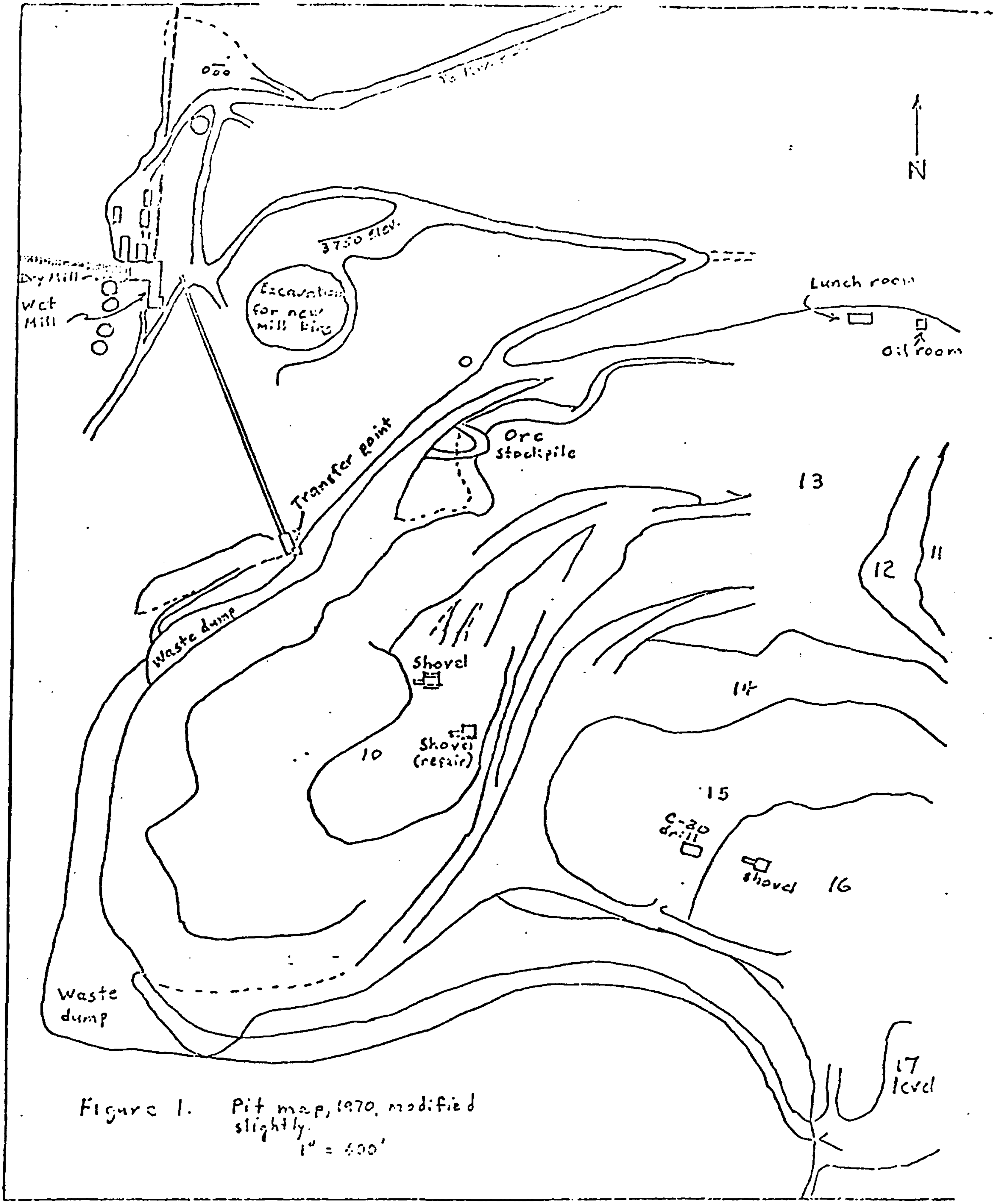

Figure 1. Pit map, 1970, modified slightly.
1" = 400'

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APPENDIX 1

Analysis of Settled Dust Sample

(When the analysis is received, will be submitted for inclusion in this report.)

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APPENDIX I - Analysis of Settled Dust Sample

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